to a large number of additional sand-eels at various stages. The greater number of them merely confirm the deductions given here; but there are one or two exceptions. A few, such as

"Liston Bank, 9 fathoms, 13th April, 1891.—Sand-eel, 15 millim.,"

have enabled me to carry the upper curve-line (Table II.) further up than by Table I. only.

There are, again, two cases—

"St. Andrews Bay, 20th May, 1895.—Sand-eel, 3 millim.
"St. Andrews Bay, 6th June, 1895.—Sand-eel, 7 millim."

—which have a peculiar importance. They are the only two instances of post-larval sand-eels of so small a magnitude occurring in May or June (see Table II.), and indicate that the two spawning-periods are only those of the predominating number, and that isolated cases may occur which bridge over the hiatus between them. At the same time it is just possible that fresh facts may come to hand and show that these cases are so numerous as to warrant our regarding the spawning-habit of the sand-eel as being prolonged over a period from January to June inclusive.

I have, in conclusion, to thank Prof. M'Intosh for kindly giving me many valuable opportunities for investigating this interesting subject.

XLII.—*Description of Two new Chætognaths* (Spadella schizoptera *and* Sagitta hispida). By F. S. Conant *.

While at Bimini, one of the Bahama Islands, in June 1892, Dr. Andrews obtained three specimens of an unknown Chætognath, which have been very kindly placed at my disposal. As it proves to be a somewhat aberrant form, a description may be not without interest; to it may be added a description of another new species, which we found in abundance at Beaufort, N. C., from April to July of 1894.

1. *Spadella schizoptera*, sp. n.

The specimens were taken in the tow-net at rising tide, and belong to that class of Chætognaths whose life is spent for

* From the 'Johns Hopkins University Circulars,' vol. xiv. no. 119, pp. 77, 78.

the most part near the bottom among the algæ, to which they have the power of attaching themselves, undoubtedly in order to escape observation. Their colour seems to be appropriate to this habitat; for while most of the Chætognaths live on or near the surface, and are very transparent, these are opaque or only slightly translucent, of a yellowish-brown colour. The tactile prominences appear as spots of darker brown, and there are irregularly distributed areas having a reddish tinge, resembling a calcareous alga common to the region. Their length is 4 millim., and the breadth unusually great in proportion to the length. The caudal segment is half the total length. Fins 5: two paired lateral and the unpaired caudal. The anterior extend on each side from a point a little posterior to the abdominal ganglion to the openings of the ovisperm ducts. The middle fins are connected with the anterior by a narrow area where the ovisperm ducts open, and extend along the caudal segment as far as the spermatic vesicles. Posteriorly each is split up into four villus-like processes, which extend backward and downward below the level of the rest of the fin, and have at their tips masses of adhesive cells for attachment. In this splitting-up of the middle fins *S. schizoptera* is unlike any Chætognath described, and upon it accordingly the name has been based. The regularity of the processes in all three specimens and the arrangement of the adhesive cells show beyond question that the structure is normal.

The caudal fin begins at the posterior margin of the spermatic vesicles, and is spatulate, as in the Spadellas ordinarily. Jaws 8. Anterior teeth 2 or 3 on each side, according to the specimen; long and recurved. Posterior teeth wanting. Corona ciliata (Hertwig's "Geruchsorgan") of a peculiar three-cornered shape and limited to the head and neck. It is unlike any form heretofore figured. There are no diverticula from the intestine anteriorly. The ovaries extend the entire length of the body-segment, and contain ova nearly mature. The ovisperm duct shows a marked difference from all other Chætognaths in being connected in the posterior part of its course with its fellow of the other side. It runs as follows:— Beginning as a blind tube at the anterior end of the ovary, midway between dorsal and ventral surfaces of the body, it passes backward, at first ventral to the ovary, then lateral and external, to its funnel-shaped opening between the anterior and middle lateral fins. At a point a little anterior to the septum between body and caudal segments it gives off a branch of comparatively wide lumen, which seems to contain spermatozoa like a receptaculum seminis, and which passes

inwards and downwards to join a similar branch from the ovisperm duct of the opposite side, the two growing narrower as they approach, and finally fusing to form a small blind tube, directed anteriorly, on the mid-line underneath the intestine.

The spermatic chambers of the caudal segment are without accessory longitudinal septa, but nevertheless show the peculiar circulation of the masses of developing spermatozoa. There is a transverse musculature in the anterior part of the body-segment, limited to the ventral half. The dorsal surface of the lateral fins and the adjoining surface of the body bear heavy masses of glandular cells.

2. *Sagitta hispida*, sp. n.

The form taken at Beaufort last year leads an active life on the surface and was an almost constant factor in the tow. The length of mature specimens varies from 7 to 11 millim. Fins 5 : the anterior long and rather slender, the middle always broader than the anterior, both broadest in their posterior part. Caudal segment one third total length. The anterior fins extend from near the level of the abdominal ganglion to a point posterior to the centre of the total length. The middle are completely separated from them by a clear space, and are situated more on the caudal than on the body segment. Jaws 8 or 9. Anterior teeth 4 or 5. Posterior vary from 8 to 14 or 15. Corona ciliata extends from a point on the head anterior to the eyes along the dorsal mid-line almost to the level of the abdominal ganglion. Its outline is narrow and sinuous. The mature ovaries may extend beyond the anterior extremity of the anterior fins. The intestine has two well-marked lateral diverticula at its beginning. The spermatic chambers of the caudal segment are divided by incomplete accessory longitudinal septa, about which the spermatic masses circulate. The spermatic vesicles have a kind of cap such as described by Grassi for *S. bipunctata*.

The tactile prominences, with the sensory hairs springing from them, are especially numerous and manifest, and give the species the bristling appearance from which it is named. In the anterior part of the body they are arranged in some twelve more or less definite longitudinal rows. Each of the middle fins has a tactile prominence on its posterior third on both upper and lower surfaces, and the caudal has six on each surface, almost constantly, arranged as in the figure (fig. 2).

S. hispida closely resembles *S. bipunctata* and *S. minima*, but differs too much to be classified with either, as a comparison of Grassi's description will show.

Fig. 1.

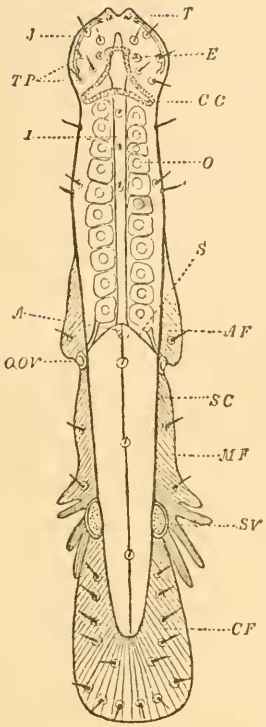

Fig. 2.

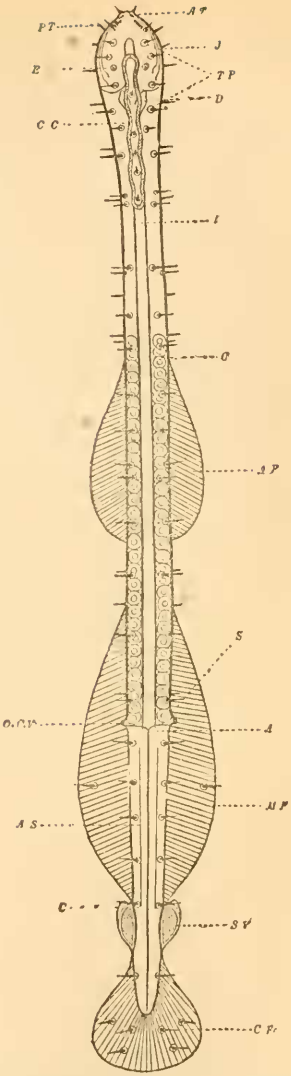

Fig. 1.—*Spadella schizoptera* (reduced from camera drawing). *T*, anterior teeth; *J*, jaws; *E*, eye; *T P*, tactile prominences; *C C*, corona ciliata; *I*, intestine; *O*, ovary; *S*, septum between body and caudal segments; *A*, anus (ventral); *A F*, anterior fin; *O. OV*, external opening of ovisperm duct; *S C*, spermatic chamber; *M F*, middle fin; *S V*, spermatic vesicle; *C F*, caudal fin. (Magnified 24 ×.)

Fig. 2.—*Sagitta hispida* (reduced from camera drawing of a small specimen). *A T*, anterior teeth; *P T*, posterior teeth; *D*, diverticula of intestine; *C*, cap of spermatic vesicle; *A S*, accessory longitudinal septa of spermatic chambers. Other letters as in fig. 1. (Magnified 26 ×.) The tufts of sensory hairs springing from the tactile prominences have been exaggerated in both figures.

Notes on the Classification of Chætognaths.

Three systems have been advocated by the writers, and as none of them seems satisfactory when tested by *Spadella schizoptera*, it may be appropriate to review them briefly.

Langerhans (Zeitschr. für wissench. Zool. Bd. xxxiv. pp. 132–136, 1880) forms three genera, based on fins and teeth:—*Sagitta*, with five fins (a caudal and two pairs of lateral) and two series of teeth; *Krohnia*, with three fins (caudal and one pair of lateral) and one series of teeth; and *Spadella*, with three—the caudal and lateral, however, being connected and lying wholly on the tail-segment—and two series of teeth. Strodtmann (Archiv für Naturgesch. Year 58, 1892) follows Langerhans.

O. Hertwig ("Die Chætognathen," Jenaische Zeitschr. Bd. xiv. 1880) makes two genera on the basis of fins alone:—*Sagitta*, with five fins; *Spadella*, with three.

Grassi ('Fauna und Flora d. Golfes von Neapel,' no. 5, 1883) takes the ground that fins and teeth are not of sufficient morphological importance, and bases his two genera on the following anatomical characteristics:—*Sagitta*: transverse musculature, adhesive and glandular cells present, some tactile prominences somewhat buried in the epidermis. The lack of these features characterizes the genus *Spadella*.

Since the Chætognaths that have these three features are in general those that have three fins, it will be seen that while this classification of Grassi's does not affect the constituency of the two genera, it interchanges the names, so that a *Sagitta* of Hertwig is a *Spadella* of Grassi. This reversion of the accustomed names gives rise to unfortunate confusion.

The difficulty with *Spadella schizoptera* now is that it has the fins of one genus with the morphological characteristics of the other. According to Langerhans' or Hertwig's systems it would have to be called a *Sagitta*, as having five fins, in spite of its distinctively *Spadella* characteristics. On the strength of a single external resemblance it would thus be separated from its nearest allies. Grassi's system, while keeping it in the same genus as its fellows, would reverse the usual name of that genus and call it *Sagitta*. As the distinctive features of the new form did not appear to warrant establishing a new genus, it seemed best to classify it, at any rate provisionally, according to a combination of Hertwig's and Grassi's systems—determining its genus according to the morphological characteristics of Grassi, so that it might be kept with its nearest allies, but retaining for that genus the name (*Spadella*) it would have in the classification of Langerhans or of Hertwig.